science-teaching in miniature; as some parents hold that infant costume should be a simple and economical adaptation of the parental garments. And so an elaborate system of lecturing, note dictating, "model answer" grinding, has been evolved, which is not only not educational and a grievous waste of the pupils' energies, but which seriously discredits the claims of science upon the school time, in the eyes of ordinary educated people.

This has been particularly the case in many middle class schools, though the recent abolition of the second class pass in the May examination has done much, as the Forty-first Report of the Department shows, towards mending the mischief. In connection with countless higher grade and small grammar schools, classes, containing as a rule only elementary pupils, and aiming really only at second class passes, have been organised from year to year. Not only was the science-teaching given in the evening classes, but a considerable portion of the daytime was devoted to model answer drill and to mechanical copying out from the text-book. The minimum of apparatus required by the Department formed a picturesque addition to the schoolroom. This discipline resulted in remunerative grants for second class passes, but it resulted in very little else, except perhaps a certain relaxation of the pupil's handwriting and a certain facility in the misuse of scientific phrases. The certificates were framed and glazed, the teacher added a few modest comforts to his home, and there the matter ended.

The examinations of the Science and Art Department were scarcely to blame in this matter, although the blame has been generously awarded them. The Science and Art Department is a large and convenient mark, it is perfectly safe to throw at, and to attack it has something of the romantic effect of David against Goliath. But we must remember that its classes were primarily, as they are still in intention, continuation and adult classes, an outcome of the Mechanics' Institute movement, and it was an unforeseen accident, and one the full bearing of which only became apparent in the course of years, that they should so seriously affect the teaching of middle-class, and even of the higher standards of elementary, schools. For their proper purpose as a test of lecture teaching, the departmental examinations are generally efficient. Far more blameworthy are examining bodies whose work is specially directed to school needs. The College of Preceptors, for instance, while subsidising lecturers upon Educational Theory, has done nothing to promote practical work in schools, and many of its examinations set a premium upon that vicious lecture and text-book cramming which educational theory condemns. And in public schools over which the Department has no influence, young gentlemen from the older universities, beginning educators without of course the faintest knowledge of educational technique, set up precisely the same imitation of the professorial course. We have in consequence such a standing argument against science teaching as that naïve testimony of a prominent headmaster, that he found boys who had followed the classical course for some years, and who then took up "science as beginners," speedily outstripped those who, to the exclusion of literary work, had been engaged during the same time in what he regarded as scientific studies.

So far the confusion between the two forms of elementary instruction has hampered science-teaching. But there can be no doubt that the educational reformer is abroad. A large, if somewhat inchoate, body of criticism has grown up, and good resolutions in the matter are epidemic. A really educational scheme of instruction in physics and chemistry now exists, having its base upon the Kindergarten, and developing side by side with elementary work in mathematics. Mr. Earl's recently published book upon Physical Measurements is an admirable exposition of what is here intended by educational science-teaching. In this, information is entirely subordinated to mental development. His course is devoted to the measurement of space, mass and time, and to the observation and methods of recording various changes involving precise determinations. The first exercise requires the pupil to "measure the size or dimensions in inches of the paper on which you are writing, using for your standard a strip of paper one inch in length, and which you have divided into halves, quarters, and eighths"; and the book concludes with experiments upon torsion and the rotation of suspended bodies. The course must inevitably constitute a firm foundation of definite concepts, and develop a clear and interrogative habit of mind. It marks the line along which school science teaching must move in the future, if it is to attain that predominance which its advocates claim for it. Yet at the same time it may not be premature to notice that the new movement has its dangers.

These dangers arise from the confusion between the two distinct forms of science-teaching whose existence is necessitated by the present condition of things. In the past the error has been to treat children like adults; in the future it may be that adults will be treated like children. Such exercises as the one we have noticed, are excellent in developing concepts, but scarcely anything could be devised more irksome and exasperating to a mind already provided with a basis of definite ideas. Nothing, for instance, could be better calculated to discourage an intelligent student of eighteen or nineteen, curious about physics, than a day or so spent in manufacturing an unreliable millemetre scale. The problems of the science are already more or less vaguely in his mind, and there is every reason why these should be made the starting-point. To produce an intellectual parallel to the spiritual re-birth, is as impossible as it would be to refer an unsatisfactory chicken back to the egg to reconsider its ontogeny. We have now, and shall have for an indefinite number of years, to provide for the needs of a great number of people whose intellectual development is nearly or quite at an end, whose curiosity about nature is already aroused, and whose practical needs are also pressing for scientific information, and yet who are ignorant of any but the veriest commonplaces of science. For them the Science and Art Department classes were designed and are well adapted. It will be an unfortunate thing if the criticisms of the educational reformer should so far overshoot the mark as to affect their instruction. Yet one might suggest that a downward age limit, similar to that of the London University Matriculation, might save many a schoolmaster from the temptations of the possibility of grant-earning—a temptation, however, from which the abolition of the second class in the elementary stage has already to some extent relieved him.

H. G. Wells.

WITH PROF. HEIM IN THE EASTERN ALPS.

THE excursion with Prof. A. Heim, of Zürich, which came to a happy end on September 15 at Lugano, was one full of interest to students of tectonic geology. It afforded those who were fortunate enough to take part a rare opportunity of seeing in the field some of the classic sections with which the name of Heim has been for many years associated, and, better still, of seeing the genial author of the "Mechanismus der Gebirgsbildung" himself climbing his native Alps as nimbly as a chamois, and expounding his own work face to face with the hard facts on which his conclusions have been based. The party, numbering at the outset twenty-three, left Zürich on the 3rd, after the close of the Geological Congress, and took train to Appenzel, spending the first night at Weissbad, a village nestling peacefully beneath the rugged peaks of the Säntis Range. This magnificent buttress of the

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Eastern Alps consists of a series of steep compressed folds of cretaceous strata rising through the Flysch and Molasse conglomerates that form the lower spurs to the north, and the summit of Säntis is the highest of one of the sharp anticlines of the range. Finer examples of sharp anticlinal peaks and ridges separated by equally acute synclinal gorges it would be difficult to find, and the well-marked petrographical and palæontological character of each zone leave no room for doubt as to the sequence and structure of the different formations. The summit of Säntis (8200 feet) is an overturned anticline of Gault, covered by a thick bed of "Seewerkalk," the highest cretaceous rock in the district, and the structure is exposed in splendid cliff sections on the sides of the peak. Prof. Heim, who is an adept at drawing panoramic sketches, was anxious that we should have an opportunity of verifying his elaborate panorama of the surrounding district, but unfortunately the mist, which had come on, did not clear off the top till the afternoon of the second day, and even then we had only a short glimpse of the glorious view beneath. Two nights were spent in the inn erected by the Alpine Club, a short distance below the observatory on the summit of Säntis, and the descent to Wildhaus was made on the north side over a steep path leading across a compressed synclinal fold of Seewerkalk, where a good example was seen of the middle part of a double fold, compressed and drawn out so as to pass almost into a thrust-plane. A better example of the "Verkehrten Mittelschenkel" was, however, seen a few days afterwards in the Mattstock near Amden, where the middle members of a compressed monoclinal fold were found in normal order from Flysch to Neocomian and Gault, but drawn out and evidently much diminished in thickness. At Obstalden, on the Wallen See, a few days were spent among the rocks on either side of the lake, a recent fall of snow having obscured the sections on the higher Alps, which we had intended to visit. One of the most interesting tectonic features of this district is an important thrust-plane, traversing the face of the Leistkamm on the north side of the lake, and repeating the section of cretaceous rocks in the mountain. The thrust-plane forms a barrier to the downward passage of water through the limestones above, and its outcrop is marked by a line of springs, one of which gushes out of the cliff in a large waterfall opposite Mühlehorn. After a visit to the Mürchenstock, with its contorted anticlinal core of Permian Verrucano conglomerate and its wrinkled skin of Jurassic rocks, we made our way southward to Glarus, and the greater part of the last week was devoted to the exploration of the celebrated "Doppelfalte" of the Glärnish, in which the red Verrucano is seen to have been pushed on to the top of Jurassic and Eocene rocks exposed in a series of magnificent mountain sections. At Lochseite, near Schwanden, a few miles south of Glarus, the massive Verrucano is seen projecting in a thick ledge from the hillside over the so-called Lochseitenkalk, a crushed irregular bed of mylonised limestone resembling that found near the great thrust-planes in the North-west Highlands. At Lochseite the thrust-plane is so sharp and clear that a knife could be drawn along between the rocks on either side, and the under-surface of the hard Verrucano is slickened and polished at places as smooth as glass. A full view of this tremendous overthrust was, however, not obtained until we had climbed some 8000 feet to the crest of the Bütistock and Kalkstöckli, between Linthal and Elm, where the sharp cut and wonderfully straight line of the great displacement was seen in profile crossing from ridge to ridge and peak to peak, and producing a marked feature in the mountain panorama. At one place where the Verrucano has been eroded off, the party rested on the smooth surface of the thrust-plane which forms the crest of the ridge, where they were photographed, with Prof. Heim standing in the midst expounding the classic sections around him. The south wing of the "Doppelfalte," or thrust-plane, was crossed between Elm and Flims at the Segnes Pass, at a height of 8615 feet, and here also the outcrop was seen in stupendous cliff sections. The overlying Verrucano being darker in colour than the limestones below, the line of displacement is everywhere very sharp and distinct. The nummulite limestone, where it approaches the thrust-plane, is drawn out and schistose, and a distinct passage was traced between unaltered nummulites and those only slightly distorted, to a rock in which they were rolled out into ribbons, which, but for the intermediate specimens, could not have been recognised as being of organic origin. The Verrucano itself is also squeezed and schistose, and the pebbles are compressed into augen, surrounded at places by sericite and mica schist. The vast interglacial (?) landslip at Flims, on the Vorder Rhein, was the last of the important objects we visited, and after a passing look at the crystalline rocks of the St. Gotthard Massiv, the party reached Lugano in detachments, where they rejoined the other members of the Congress, all highly pleased with their respective excursions across the Alps, and were greeted on their arrival by a discharge of artillery, followed in the evening by a splendid pyrotechnic display on the lake.

H. M. C.

NOTES.

THE Physical Society, which has for many years met in the Royal College of Science at South Kensington, give notice of some important changes. The Council have, after careful consideration, come to the conclusion that the meetings of the Society would be more accessible to the majority of the members if they were held in some more central situation, and the meetings will therefore henceforward be held on the same day and at the same hour as heretofore, but in the rooms of the Chemical Society, in Burlington House. All communications to the secretaries or other officers of the Society may in future be addressed to Burlington House or to the secretaries at their respective addresses as given in the list of members of the Society. The Council have also decided to initiate the publication of a series of abstracts of papers on physics, but the resources at their command being slender make it necessary to begin cautiously. At first abstracts will only be given of papers which appear in a certain number of the more important foreign magazines. They will for a time be edited by Mr. Swinburne, and will be published regularly at the beginning of each month in the form of a supplement to the Proceedings of the Society. The first number will be issued in January 1895. Should the scheme prove successful it is intended to enlarge its scope. For some time past printed copies of the more important papers have been circulated before the meetings among members who are likely to take part in the discussion on them; it has, however, been felt that cases may arise in which the author may wish that his paper should be published as soon as possible. The Council have therefore decided that, if an author so desires, and if such a course appears desirable, they will take steps to ensure that the publication of a paper is not in any way delayed in order that it may be read before publication, and that they will if necessary postpone the reading and discussion of a paper until after it has been published.

WE are informed that a petition, signed by a number of science masters, has been sent, through Sir Henry Roscoe, to the Secretary of State for War, supporting the Departmental Committee's proposal to introduce a compulsory science subject into the entrance examinations for Woolwich, which, the masters consider, will encourage thorough science teaching in the schools, and be to the advantage of education generally.

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